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Editorial

AN EAST AFRICAN INSTITUTE OF VETERINARY RESEARCH

AT the Conference of East African Veterinary Officers, which met last month in Kenya Colony, a suggestion was made that the Laboratory in Nairobi should be the headquarters of medical and veterinary research for problems connected with the livestock industry of East Africa. In 1931, the Joint Select Committee noted the advantages of Kabete for Veterinary Research; and in 1934, when the first Veterinary Research Conference was held the principle ot centralisation was approved. The Veterinary Laboratory at Kabete is one of the best equipped in the world for the prosecution of research into the diseases of animals, and the work of its Staff, under the Chief Veterinary Research Officer, Captain Robert Daubney, M.Sc., M.R.C.V.S., has attained world-wide recognition.

The establishment of a central headquarters of this kind has not only the benefit of bringing into closer contact the workers of the other African Centres,

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both of veterinary and of human medical science, but by the periodical holding of Conferences in a Research Centre of this kind there is the additional benefit of allowing programmes to be planned without overlapping, and with a more complete picture of the problems of East Africa as a whole. The question of rinderpest control is an immediate case in point; nor is it necessary to assume that in either sphere there need be any real departure from the sometimes sound practice of carrying out research in more than one territorial centre at once; and it certainly should be a part of research policy either to minimise or to restrict the national development of research work in the field in areas, near or distant, where there are workers qualified to collaborate with the central team of specialists. Centralisation will moreover permit programmes to be planned and the special needs of each territory more fully understood and carried out under a " Director of Veterinary Research " who must have not only the scientific knowledge, but also the administrative ability to co-ordinate all the resources in men and money at his disposal.

Among other topics the following subjects of common interest to Kenya, Uganda, and Tanganyika were discussed:—

The control of Rabies.

Improvements in the preparation and marketing of hides and skins.

The supply of pleuro-pneumonia vaccine.

The training of African veterinary personnel.

Proposals for reinforcing the investigations into various problems of animal health by the creation of a special team of research workers, under inter-territorial control, at Kabete.

The Committee's recommendations on these various topics are being submitted to the East African Governments for their approval.

The suggestion is warmly welcomed in the Editorial columns of the *East African Standard* and we thoroughly endorse it as that of the man on the spot. It is a still further argument for the re-establishment of the centralised post under the Colonial Office which was rendered vacant by the death of our late distinguished colleague, Mr. Montgomery. There is no doubt whatever of the value of a competent liason officer, not only between the Departments of our various Colonies, but also between them and the Colonial Office at home.

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General Articles

THE ERADICATION OF TUBERCULOSIS FROM A COMMERCIAL DAIRY HERD

By Sir JOHN KELLAND and J. L. FROOD
Diseases of Animals Branch, Ministry of Agriculture,
and T. M. DOYLE
Veterinary Laboratory, Ministry of Agriculture, Weybridge.

In 1934 the Ministry of Agriculture was consulted by a landowner regarding the control of Tuberculosis in the dairy herd on his estate in Surrey.

The estate, which consisted of about 900 acres, bounded on three sides by public roads and on the fourth by a river, so that the cattle did not come into contact at any point with neighbouring herds, was divided into five farms which were in the main run as separate units. Four of these were used for the milking herd while the fifth farm was used exclusively for the temporary accommodation of animals which had reacted to the tuberculin test or were being disposed of for other reasons.

The herd, which was made up of approximately 200 pedigree Guernsey and Shorthorn cows and heifers and 50 young stock, was run on a strictly commercial basis producing certified and Grade A (T.T.) milk. Neither pigs nor poultry were kept on the estate.

The owner had a second estate in Suffolk to which it will be necessary to refer occasionally, as there was a constant interchange of cattle between the two estates; most of the calves bred on the Surrey estate were transferred to Suffolk, a proportion returning later as replacements to the dairy herd.

A considerable number of pedigree Guernsey calves were purchased annually in Guernsey some of which were reared in Surrey and some in Suffolk. A point of practical interest is that no reactor has ever been found among this stock within a year of arrival.

It was the custom until 1934 to carry out tuberculin tests of all bovine animals every six months, the dairy herd being tested in January and July and the young stock in March and November. Animals that reacted to the test were immediately removed from the herd and isolated until either sold for slaughter or transferred to a special isolation farm on the Suffolk estate.

The owner, who was keenly interested in the subject of tuberculosis, had made strenuous efforts during the period 1917 to 1934 to eradicate the disease from his Surrey herd but without success.

The subcutaneous tuberculin test was used in the early years and the double intradermal test from the time of its introduction.

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An examination of Table I will show that during the period 1917-1934, a total of 556 animals were removed from the herd as being reactors to the tuberculin test and at the end of that period the disease still persisted.

Present Inquiry.

In view of the continued failure to eradicate the disease under the excellent conditions obtaining on this Estate, the possibility of the existence of some unrecognised complicating factor, and particularly on account of the increasing public interest in the control of tuberculosis, the Ministry of Agriculture decided to co-operate with the Estates Veterinary Surgeon in investigating the problem.

The following recommendations were made:

(1) Tuberculin tests of the herds, using synthetic tuberculin, to be made every 60 days until at least two negative tests were obtained. The interval between tests to be then extended to three and later to six months.

(2) Reactor cattle to be immediately removed from the herd (this has in fact always been the practice) and doubtful reactors held in isolation pending a retest.

(3) The use of certain calving boxes on one of the farms to be discontinued as owing to their structure adequate disinfection was impossible. A range of six new boxes has since been erected on this farm. Minor alterations on other farms to facilitiate disinfection. Thorough disinfection of byres, yards, etc.

Tuberculin Tests.

Synthetic tuberculin prepared at the Institute of Animal Pathology, Cambridge' was used throughout these tests with satisfactory results. A couple of brews gave rise to small hard swellings in a large proportion of the negative animals, but the nature of these swellings readily distinguished them from the reactions exhibited by tuberculous animals.

Two tests were made simultaneously on each animal, a double intradermal in the neck and a single intradermal in the sub-caudal fold.

At the beginning of the work a considerable number of animals were tested also in the vulva, but the use of this site was discontinued as in our limited experience it appeared to be less sensitive than either the neck or caudal fold. Animals that reacted to the vulva test were invariably found on post-mortem examination to be infected, but a number of infected animals failed to react in this site. This finding is contrary to American experience, but it should be noted that we were using a different type of tuberculin (a precipated tuberculin as opposed to a heat concentrated tuberculin.)

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TABLE I

SHOWING RESULTS OF TUBERCULIN TESTS OF HERD FROM 1917 TO 1937

Year	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928
Average number of animals in herd	—	—	—	—	—	—	—	340	335	342	270	249
Number of Tests made ...	61	163	146	462	607	426	309	467	585	639	476	476
Number of Reactors ...	15	36	4	100	58	45	28	16	16	40	35	48
Percentage of Reactors ...	—	—	—	—	—	—	—	4.7	4.7	11.4	12.9	19.2

	1929	1930	1931	1932	1933	1934 Jan. to July		1934 From July	1935	1936	1937
Average number of animals in herd	240	271	299	281	283	269	Tuberculin Testing	269	196	199	234
Number of Tests made ...	458	454	504	483	510	238	taken over by the	477	1137	1213	504
Number of Reactors ...	28	15	20	32	15	7	Ministry in July,	31	10	6	—
Percentage of Reactors ...	11.6	5.1	6.6	11.3	5.2	2.6	1934.	11.5	5.1	3.0	—

The neck site would appear to be slightly more sensitive than the caudal fold and small reactions are probably easier to interpret. This is, however, a matter of personal opinion and our results obviously do not lend themselves to any true comparison between the sites, as a double injection of tuberculin was given in the neck and a single only in the caudal fold.

A combination of the neck and caudal fold tests gave good results, the two tests almost invariably confirming each other both in the nature and in the degree of reaction exhibited by tuberculous animals.

A simultaneous application of two tests may perhaps be considered unnecessary but it does at times give more confidence in arriving at a decision in difficult cases.

The prescribed method of testing under the American Tuberculosis eradication scheme is a combination of the sub-caudal fold and vulva tests using a single injection of tuberculin in each site.

The percentage of infected animals in which a second injection of tuberculin is necessary in the neck test, in order to make a diagnosis is a point of considerable economic importance that could not, however, be readily investigated in a commercial herd, but in our experience it would appear to be small.

Using bovine tuberculin the neck site appeared to be considerably more sensitive than the caudal fold in cases of avian tuberculosis of cattle and in the condition known as " skin Tuberculosis."

It would serve little useful purpose here to describe typical tuberculin reactions as this has been adequately done by Buxton and Glover in this country and by American writers; and no description, however good, can replace or reduce the need of considerable practical experience supplemented by careful post-mortem and biological examinations of reactor animals.

Results of Herd Tests.

At the first herd test carried out by us in 1934 twenty-two animals gave typical reactions to the test (see table III). Eight of these were submitted to post-mortem and biological examinations and the existence of tuberculosis confirmed in seven; the probable reason for the failure to detect the infection in the remaining animal, Angelica, is dealt with later under the post-mortem details. Nine reactors were detected at a second test about sixty days later. During 1935, three herd tests were made and ten reactors found.

During 1936, six animals reacted to the test, but in only two (Athol and P. Maidenhair) of these could the reactions exhibited be regarded as typical of bovine tuberculosis.

Some of the animals showing atypical reactions were probably not infected with bovine tuberculosis, and six of these were bought by the Ministry for examination.

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A total of forty-seven animals were removed from the herd as having failed to pass the test.

All tests of the herd from August, 1936, up to date have been negative. Official tests have been carried out by the Ministry of Agriculture and the four units comprising the herd have been " attested."

Post-Mortem Examination of Reactor Animals.

An examination was made of the lymphatic glands and organs and in the absence of naked-eye lesions of tuberculosis, the principal glands were grouped and material inoculated into guinea pigs and fowls.

The glands were grouped as follows, the number after each group signifies the number of guinea-pigs usually inoculated.

Popliteal Precrural Prescapular	4	Pharangeal Submaxillary	6	Bronchial Mediastinal	6
Hepatic Iliac	4	Messenteric	6	Supramammary	4

The glands, after removal of adhering tissue, were dipped in methylated spirits and flamed. They were then cut into thin sections, and in the absence of tuberculous lesions, were pulped and suspended in normal saline, allowed to stand for 30 minutes and the supernatant fluid injected (2 c.c.) into 30-32 guinea-pigs; half the guinea-pigs of each group were inoculated subcutaneously and half intraperitoneally. In addition six to eight tuberculin-tested fowls were inoculated intramuscularly (4 c.c.) with a pooled suspension of the various glands. We are indebted to our colleague, Mr. N. Dobson, for kindly supplying the tuberculin-tested fowls.

The not infrequent condemnation of the tuberculin test because of failure to find naked-eye lesions of tuberculosis in a reactor animal on a somewhat casual autopsy made under unfavourable conditions is unwarranted. It is essential in the absence of visible lesions to slice the principal lymphatic glands into thin sections and to make biological tests before questioning the accuracy of the test. It is almost impossible to make such a thorough examination without the facilities provided by a laboratory.

It should also be borne in mind that an animal infected with an avian strain of M. Tuberculosis may show a moderate reaction to mammalian tuberculin, and on autopsy either no lesions can be found or only small discrete lesions that may easily be overlooked in the absence of a thorough examination. Further, an animal affected with " skin tuberculosis " may react to either mammalian or avian tuberculin or to both.

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Results of post-mortem and biological examinations of Reactors.

Angelica.

	N.	48 hr.	72 hr.
Intradermal Test ...	7	12	17
Caudal Fold	—	—	—

Post-Mortem.—No macroscopic lesions found.

Thirty guinea-pigs and six fowls inoculated with suspensions of the various lymphatic glands showed no evidence of tuberculosis.

This animal was killed at a slaughter-house, the carcase was opened before our arrival and there was some doubt as to whether the organs examined belonged to this particular animal.

Gunnera.

	N.	48 hr.	72 hr.
Intradermal Test ...	8	15	24
Caudal Fold	—	1X	3X

Post-Mortem.—Caseous lesions containing acid fast bacilli, were present in the bronchial glands. Four guinea-pigs inoculated with material from the glands developed tuberculosis.

Avril de l'eclet.

	N.	48 hr.	72 hr.
Intradermal Test ...	8	18	18
Caudal Fold ...	—	2X	3X

Post-Mortem.—Numerous small caseo-calcareous lesions, containing acid-fast bacilli, were present in the bronchial glands. Four guinea-pigs inoculated with material from the glands developed tuberculosis.

Guernsey Bull.

	N.	48 hr.	72 hr.
Intradermal Test ...	11	47	50
Caudal Fold	—	8X	8X

Post-Mortem.—Tuberculous lesions were present in both pharangeal lymphatic glands. Four guinea-pigs inoculated with material from the lesions developed tuberculosis.

Drop Wort.

	N.	48 hr.	72 hr.
Intradermal Test ...	10	15	14
Caudal Fold	—	2X	3X

Post-Mortem.—Tuberculous lesions were present in both pharangeal lymphatic glands. Four guinea-pigs inoculated with a suspension of the lesions developed tuberculosis.

Teasel.

	N.	48 hr.	72 hr.
Intradermal Test ...	7	11	17
Caudal Fold	—	2X	1X

Post-Mortem.—Tuberculous peritonitis.

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Gold-dust 5th.

	N.	48 hr.	72 hr.
Intradermal Test ...	7	19	24
Caudal Fold	—	6X	8X

Post-Mortem.—Bronchial glands were enlarged and showed numerous caseous lesions containing acid fast bacilli. Six guinea pigs inoculated with suspensions of the glands developed tuberculosis.

Joey 4th.

	N.	48 hr.	72 hr.
Intradermal Test ...	9	13	15
Caudal Fold	—	1X	—

Post-Mortem.—No macroscopic lesions found.

Guinea-pigs inoculated with suspensions of mediastinal and bronchial glands developed tuberculosis.

Anomalous Tuberculin Results.

A CONSIDERABLE number of anomalous tuberculin reactions occurred during routine testing on the two estates, most of which can reasonably be attributed to either the so-called " skin tuberculosis " or to avian tuberculosis. Thorough post-mortem and biological examinations elimated the possibility of the existence of bovine tuberculosis.

The reactions were usually smaller and rather less oedematous than those observed in animals infected with bovine tuberculosis; these reactions are distinct from the very small non-specific reactions that may occur in negative animals. The actual increase in thickness of the skin, as shown by measurements, is not always, however, a good indication of the extent of the reaction, the area involved not infrequently being greater than might appear from the recorded increase in the skin measurements.

The reactions in a few of the animals affected with skin tuberculosis on the Suffolk estate were indistinguishable both in character and size from those of true tuberculosis.

Skin Tuberculosis.

From the 19/3/35, when the first case of skin tuberculosis was observed, every reactor or doubtful reactor to the tuberculin test was carefully examined for the presence of this condition. It must be admitted, however, that the most careful examination during life may at times fail to detect a small lesion, as for example, case No. 9, described by Robertson and Hole (1937). Six animals with clinical lesions of the disease were observed on the Surrey estate and twenty on the Suffolk estate.

Seven of these animals were bought and as we were unable, owing to pressure of other work, to devote to it the time demanded by this important problem, we passed them for investigation to our colleagues, A. Robertson and N. H. Hole,

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who have published the results of their observations. Skin tuberculosis was found in three other animals from the Suffolk estate sent for autopsy to Weybridge.

It is reasonable to conclude that in addition to the clinically affected animals others in the herd were sensitized to tuberculin by the same casual agent.

It would appear to be established that animals affected with this condition may react to either mammalian or avian tuberculin or to both, and it is not improbable that some of the anomalous results of tuberculin tests that have been reported from time to time in this country, were the result of the unrecognised existence of this disease.

Crawford (1936) states that it is the general opinion of the Bureau of Animal Industry Staff engaged on Tuberculosis eradication work, that animals affected with skin tuberculosis usually react once only to the tuberculin test.

The following experience met with during the course of routine testing on the Suffolk estate lends support to this view.

Fourteen heifers out of a group of twenty believed to be free from Tuberculosis gave positive reactions to the tuberculin test. The majority of these animals exhibited lesions of skin tuberculosis on the legs. They were isolated for sixty days and on re-test none reacted although some still showed typical skin lesions. The minimum period after the initial test at which desensitization occurs is a point of considerable practical importance that does not yet appear to have been determined.

Avian Tuberculosis.

The first case of avian tuberculosis on the Suffolk Estate was found in a calf (Lamhill 9th) examined on the 16/12/34 at the laboratory. For details of the examination see under post-mortem results.

The existence of avian tuberculosis was proved in two other calves (Poppy 6th and Ulex 2nd) from the Suffolk Estate sent for examination to Weybridge.

In view of these results an inquiry was made to ascertain the source of infection.

Large numbers of fowls were used for hatching pheasant eggs, but as these did not come in-contact with cattle the possibility of infection from this source was dismissed.

A considerable number of fowls of varying ages were kept in small lots on different farms by members of the Estate Staff and in some instances these came in-contact with the cattle.

Tuberculin tests of these fowls were carried out using a single injection (0.1 c.c.) of synthetic tuberculin in the wattle and reading the results at the 48th hour.

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TABLE II

SHOWING RESULTS OF TUBERCULIN TESTS OF FOWLS.

Date.	Number Tested	Number Positive	Remarks
January, 1935 ...	22	11	Post-mortem examination of a number of reactors confirmed the result of the test. Four fowls that passed the test were killed on account of emaciation and were found to be tuberculous.
February, 1935 ...	1,457	56	
March, 1935 ...	320	6	
May, 1935 ...	150	—	
June, 1935 ...	376	14	
July, 1935 ...	973	32	
November, 1936 ...	252	3	
March, 1937 ...	1,195	11	
Total	4,745	133	

These fowls were apparently the source of the avian tuberculosis in the cattle and immediate steps were taken to eliminate this danger. The results of the tests provide further evidence of the not infrequent failure of tuberculin to detect heavily infected fowls. It is advisable when carrying out tuberculin tests of infected flocks to remove emaciated fowls that have passed the test.

Plum (1931) stated that bovines infected with avian strains of tubercle bacilli may react strongly to the tuberculin test and show no tuberculous lesions on autopsy. Many calves were examined at the Serum Laboratory, Copenhagen, which as the result of their tuberculin reactions were considered to be infected with avian tuberculosis, but in only comparatively few cases were naked-eye lesions of the disease found.

Minett (1932) recorded the finding of five cases of avian tuberculosis in cattle in Great Britain. In three of the five animals no naked-eye lesions of tuberculosis were found at autopsy. From four animals avian strains of the M. tuberculosis were isolated from the mesenteric lymphalic glands and in the fifth from the apparently normal intestinal mucous membrane. He pointed out that bovines naturally infected with avian tuberculosis may react to intradermal tests with johnin as well as with avian tuberculin. Two animals (C.72 and 19) were still highly sensitive to avian tuberculin and johnin six months after removal from contact with fowls.

Plum (1933) observed that tuberculin sensitivity in cattle infected with avian tuberculosis gradually fades out in six to twelve months after the source of infection had been removed.

Schalk and his co-workers (1935) found that:

> " Minimal quantities of avian tubercle bacilli are capable of provoking that condition of hypersensitiveness [in cattle to avian tuberculin] but it is seldom indeed that the condition develops to a point where it can be detected by the usual methods of examination nor can gross evidence of the disease be found except on rare occasions."
>
> " The sensitivity of such cattle to avian tuberculin disappears within a few months after the termination of the exposure to the tuberculous fowls."

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The fact that many cattle sensitized with avian tubercle bacilli do not present naked-eye lesions of the disease on autopsy introduces a complication to the test that should always be borne in mind.

When a single animal reacts to mammalian tuberculin in a self-contained herd, believed to have been free for some time from tuberculosis, it is advisable to retest it with avian tuberculin before taking action.

In view of the considerable incidence of tuberculosis in poultry flocks on general farms in Great Britain there would appear to be good grounds for believing that avian tuberculosis in cattle may be fairly prevalent.

Post-Mortem and Biological Examinations of Animals showing Anomalous Reactions.

Centuary.

	N.	48 hr.	72 hr.
Intradermal Test ...	7	8	13
Caudal Fold		—	—

Post-Mortem.—No macroscopic lesions found.

Thirty guinea-pigs and six fowls inoculated with suspensions of the various glands showed no evidence of tuberculosis.

Sorrell 7th.

	N.	48 hr.	72 hr.
Intradermal Test ...	6	10	10
Caudal Fold	—	1X	—
Vulva	—	—	—

Post-Mortem.—(Made by Mr. A. V. Franklin, M.R.C.V.S.) No macroscopic lesions found.

Several small nodules, containing a thick, yellow, glairy pus, were found on the skin below the elbow joint. Smears of the pus showed numerous acid fast bacilli. This case, previously reported by Hole and Robertson (1937), is apparently the first recorded in Great Britain of the so-called "Skin Tuberculosis" of American authors.

Aspen.

	N.	48 hr.	72 hr.
Intradermal Test ...	8	12	12
Caudal Fold	—	4X	2X

Post-mortem.—Three small calcareo-caseous nodules, about 2 mm. in diameter were found in the mesenteric glands. Microscopic examination failed to reveal acid fast bacilli. Thirty guinea-pigs and six fowls inoculated with suspensions of the various glands showed no evidence of tuberculosis.

This animal had been for about one year on the Suffolk Estate where the existence of avian tuberculosis had been established. It had been tested there three times with broth tuberculin with negative results. It was then transferred to the Surrey Estate where it passed three successive tests, with synthetic tuberculin. At the fourth test it gave the reactions shown above. It was then given

a single intradermal injection of avian tuberculin in the neck and according to notes made at the time, the animal reacted, but unfortunately the measurements of the swelling were not entered in the records.

In view of the presence of the small lesions confined to the mesenteric glands, the reaction to avian tuberculin and the results of the biological tests, it would appear reasonable to regard this as a retrogressive case of avian tuberculosis.

Salvia 14th.

	N.	48 hr.	72 hr.
Intradermal Test ...	7	10	15
Caudal Fold		—	—
Intradermal Test ... (avian tuberculin)	7	10	9

Post-mortem.—No macroscopic lesions found.

Thirty guinea-pigs and six fowls inoculated with suspensions of the various lymphatic glands showed no evidence of tuberculosis. A careful examination failed to reveal lesions of " skin tuberculosis."

Corncockle.

	N.	48 hr.	72 hr.
Intradermal Test ...	6	7	10
Caudal Fold		2X	3X

Post-mortem.—No macroscopic lesions found.

Twenty-four guinea-pigs, eight rabbits and eight fowls inoculated with material from the various lymphatic glands showed no evidence of tuberculosis.

Vine 13th.

	N.	48 hr.	72 hr.
Intradermal Test ...	6	7	10
Caudal Fold		2X	2X

Post-mortem.—No macroscopic lesions found.

Twenty-four guinea-pigs, eight rabbits and eight fowls inoculated with material from the various lymphatic glands showed no evidence of tuberculosis.

Fuchsia 3rd.

	N.	48 hr.	72 hr.
Intradermal Test ...	7	7	10
Caudal Fold		1X	1X

Post-mortem.—No macroscopic lesions found.

Twenty-four guinea-pigs, four rabbits and eight fowls inoculated with suspensions of the various lymphatic glands showed no evidence of tuberculosis.

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Funkia.

This animal was purchased as a yearling in November, 1931, by the Suffolk Estate. It was tested as follows:

Date	Tuberculin	Measurements. N.	48 hr.	72 hr.	Result	Place of Testing
December, 1931	Broth				Negative	Suffolk Estate
April, 1932	,,	9	11	15	,,	,,
September, 1932	,,	9	11	11	,,	,,
April, 1933	,,	9	12	14	,,	,,
July, 1933	Synthetic	8	10	12	,,	Surrey Estate
January, 1934	,,	8	16	30	Positive	,,

The animal was held at the isolation farm and retested in February, 1934, with broth tuberculin and synthetic tuberculin on opposite sides of the neck.

	N.	48 hr.	78 hr.
Broth Tuberculin ...	8	18	20
Synthetic Tuberculin ...	8	10	18

The animal was retained on the isolation farm until July, 1934. It was not tested by us, but in view of its history was bought for examination. It was tested with synthetic tuberculin on arrival at the Laboratory with the following result:

	N.	48 hr.	78 hr.
Intradermal Test ...	8	8	8
Caudal Fold		—	—

The animal was slaughtered seven days after the last test.

Post-mortem.—No macroscopic lesions found.

Thirty-two guinea-pigs and six fowls inoculated with suspensions of the various lymphatic glands showed no evidence of tuberculosis.

As the post-mortem examination was made before the recognition of the first case of skin tuberculosis no special search was made for lesions of this condition.

Cyrene of Les Merriennes.

This was one of three maiden Guernsey heifers that showed some reaction to the tuberculin test; twenty other heifers in the same group passed the test. The reactions in the three animals were similar, and consisted of small hard, very slightly oedematous, painless swellings.

	N.	48 hr.	72 hr.
1*st Test.*			
Intradermal Test ...	6	9	13
Caudal Fold		—	—
2*nd Test* (60 *days later.*)			
Intradermal Test ...	6	12	12
Caudal Fold		—	—

As this appeared to be an interesting case the animal was bought by the Ministry for examination.

Post-mortem.—No macroscopic lesions found.

Thirty guinea-pigs and six fowls inoculated with material from the various glands showed no evidence of tuberculosis.

The two companion animals with their test results were as follows:

(1) Polly of Les Meriennes.

1*st Test.*

	N.	48 hr.	72 hr.
Intradermal Test ...	10	15	14
Caudal Fold		—	—
2nd Test (60 *days later*).			
Intradermal Test ...	10	12	12
Caudal Fold		—	—

(2) Princess Rose of Les Videclins.

1*st Test.*

	N.	48 hr.	72 hr.
Intradermal Test ...	7	9	13
Caudal Fold		—	—
2nd Test (60 *days later*).			
Intradermal Test ...	7	8	8
Caudal Fold ...		—	—

These animals were eventually returned to the herd and have since passed many tests.

P. Lemphill 9th.

This animal was tested with broth tuberculin on the Suffolk Estate and gave the following reaction:

N.	48 hr.	72 hr.
6	14	28

It was sent three months later to Weybridge for post-mortem examination and gave the following result when tested with synthetic tuberculin on arrival

	N.	48 hr.	72 hr.
Intradermal Test ...	6	6	9
Caudal Fold		—	—
Vulva		—	—

Post-mortem.—Several small caseo-calcareous nodules were present in the mesenteric glands, containing numerous acid fast bacilli.

Ten guinea pigs and eight fowls were inoculated with suspensions of the lesions.

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On subsequent examination the guinea-pigs showed no evidence of bovine tuberculosis. Seven of the eight fowls developed lesions of tuberculosis in the liver and spleen and an acid fast organism exhibiting the cultural characteristics of the avian tubercle bacillus was isolated from them.

TABLE III

SHOWING TUBERCULIN REACTIONS OF ANIMALS REMOVED FROM HERD

Date	No. of Animal	Name	Farm		S. Caudal Fold			
				normal	48 hr.	72 hr.	48 hr.	72 hr.	Remarks
23/7/34	166G.	P. Elsa	H.	8	27	24	5X	4X	Sold
,,	42S	Gilia 2nd	H	8	15	25	2X	3X	Sold
,,	282S	Paigle	H	8	15	21	—	—	Sold
,,	308S	Bindweed	H	8	16	20	2X	3X	Sold
,,	315S	Clematis	H	7	20	50	5X	6X	Sold
,,	324S	Angelica	H	7	12	17	1X	2X	*See post-mortem details
,,	389S	Cyclamen	H	7	15	16	1X	2X	Negative
,,	393S	Phacelia	H	7	13	34	4X	6X	Sold
,,	399S	Gunnera	P	8	15	24	1X	3X	*Tuberculosis
30/7/34	123G	B. of Chislehurst	P	9	14	22	1X	2X	Sold
,,	158G	A. L'Eclet	P	8	18	18	2X	3X	*Tuberculosis
,,	170G	P. Lena 2nd	P	8	12	18	1X	2X	Sold
,,	Bull	P. Noble	P	11	47	50	8X	8X	*Tuberculosis
,,	292S	Dropwort	P	10	15	14	2X	3X	*Tuberculosis
,,	301S	Teasel	P	7	11	17	2X	1X	*Tuberculosis
,,	305S	Hortensia	P	8	14	15	3X	2X	Sold
,,	486S	Erica	P	9	21	24	4X	5X	Sold
,,	623S	Gold Dust 5th	P	7	19	24	6X	8X	*Tuberculosis
,,	680S	Joey 4th	P	9	13	15	—	—	*Tuberculosis
,,	758S	Marigold 12th	P	7	20	28	6X	4X	Sold
,,	774S	Thistledown 14th	P	7	17	17	4X	5X	Sold
,,	783S	Dahlia 5th	P	11	25	30	3X	3X	Sold
1/10/34	19G	Glenora's Peach	P	6	18	14	1X	1X	Sold
,,	19S	Ancona 2nd	H	8	13	14	1X	1X	Sold
,,	487S	Century	H	7	8	13	—	—	*Negative
,,	669S	P. Coronet 12th	H	6	10	13	1X	1X	Sold
8/10/34	299S	Agrimony	H	7	13	15	Not	done	Sold
,,	210G	Baince's Hero 2nd	P	5	11	13	2X	1X	Sold
,,	134S	Achilla	P	8	16	14	5X	5X	Sold
,,	431S	Polyanthus	P	6	20	20	3X	3X	Sold
,,	678S	P. Lilac 8th	P	6	14	14	1X	1X	Sold
7/1/35	308G	Alder	H	6	8	11	2X	1X	Sold
,,	236S	Bugloss	R	7	10	12	1X	1X	Sold
14/1/35	405S	Amarylis	R	6	13	17	2X	1X	Sold
,,	178G	P. May 2nd	P	8	30	25	2X	3X	Sold
,,	197G	Jessica's Jewel	P	8	14	13	1X	2X	Sold
,,	273G	Cyrene's Beaty	P	6	9	11	IX	1X	Sold
,,	126S	Columbine	P	6	10	14	2X	2X	Sold
12/3/35	772S	Sorrel 7th	P	6	10	10	1X	—	Skin *Tuberculosis
13/3/35	312G	Aspen	H	8	12	16	4X	2X	Avian *Tuberculosis
12/8/35	831S	Salvia 14th	H	7	12	15	1X	3X	*Negative
2/3/36	475S	Corncockle	H	6	7	10	2X	3X	*Negative
,,	768S	Vine 13th	H	6	7	10	2X	2X	*Negative
,,	788S	Fuchsia 3rd	H	7	7	10	1X	1X	*Negative
9/3/36	828S	Ruby 7th	P	7	9	11	Not	done	Sold
4/5/36	958S	Athol	R	7	15	15	2X	1X	Sold
30/6/36	224G	P. Maidenhair	R	6	10	15	1X	1X	Sold

*Post-mortem and biological examinations made.

Discussion.

The success achieved in eradicating tuberculosis from this herd within a relatively short period (1934-36) is of interest and of some practical importance as unremitting efforts for seventeen years had previously failed.

It should be stated here that the general standards of management, housing and hygiene in this herd were superior to those obtaining on the average commercial dairy farm, but these were no different during the period under review than during previous years so can have had little bearing on the eradication of the infection.

During the years 1917-1934, five different Veterinary Surgeons carried out the tests and all were competent men with long experience of this work. There is some evidence suggesting that in their anxiety to eradicate the infection they may have been at times unduly severe in their interpretation of the tests. Some animals that had been classed as reactors were transferred to an isolation farm on the Suffolk Estate and subsequently passed many tests.

In the light of the information now available regarding the presence of avian Tuberculosis and " skin tuberculosis " it is probable that some of the reactors were infected with one or other of these conditions and as is frequently the case failed to react a second time.

The use of synthetic tuberculin, in place of broth tuberculin, undoubtedly facilitated the eradication of the infection by reducing the number of anomalous results and generally improving the accuracy of the test.

It would be unwise, however, to regard its use as a factor of primary importance because as Dorset (1934) has pointed out in discussing the relative values of synthetic and broth tuberculins, that while the synthetic tuberculin is much the superior product, the experience of the Bureau of Animal Industry, has proved that repeated tests of herds with broth tuberculin is remarkably efficient in eradicating the disease but that the rate of progress is slower.

When the existence of bovine tuberculosis had been confirmed by post-mortem and biological examination of seven animals that had exhibited typical tuberculin reactions, attention was concentrated on animals showing atypical reactions. Seven of these animals were bought and in five of them careful examination failed to reveal any evidence of either tuberculosis or of " skin " tuberculosis.

In addition to the animals bought by the Ministry for post-mortem examination a number of others were observed during the routine tests exhibiting small atypical swellings that could neither be ignored nor on the other hand regarded as positive reactions. These animals were isolated and in the course of a few months all ceased to react and were returned to the herd where they have since passed many tests.

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It may be contended that we have not produced evidence that these were specific tuberculin reactions, and that they may well have been non-specific reactions. Our experience during recent times suggests that when the infection is eradicated these atypical reactions disappear. Furthermore, these small reactions apparently do not occur to such an extent nor do they persist for such a long time in herds infected only with bovine tuberculosis. We believe that in the present instance they were probably the result of sensitization by either avian tubercle bacilli or by the acid fast organism generally regarded as the causal agent of " skin tuberculosis."

Having regard to all the facts we are forced to the conclusion that the main cause of the failure in the past to eradicate the disease from this herd was undoubtedly the long interval between tests. In view of the established fact that macroscopic lesions of tuberculosis can be found in the lymphatic system within three months of infection occurring it is clear that an interval of six months between tests is too long, and permits the further dissemination of infection.

Indeed, the tuberculin testing of infected herds at intervals of six months with the object of eradicating the disease would appear to be of relatively little value. It reduces the incidence of infection, but does not usually eradicate it. Reactors are generally found at each test, and the financial loss incurred by the owner over a period of years is far higher than when short interval testing is practised and with the added disadvantage that the infection persists in the herd.

Tuberculin tests carried out every six months provide considerable protection to the public against the excretion of tubercle bacilli in the milk, but the owner has to bear the heavy financial loss consequent to the disposal of valuable animals at inopportune times, without receiving any compensatory benefit.

Short interval testing would give increased protection to the public and would benefit the owner by reducing his financial loss through the early eradication of the disease.

Tuberculin testing at long intervals of infected herds would, therefore, appear to be a wasteful procedure that cannot be justified on either scientific or economic grounds.

There is ample evidence available to prove that the intradermal tuberculin test made in either the neck or caudal fold is in the hands of a competent and experienced worker, using a potent tuberculin, a test of great accuracy.

The repeated application of the test at frequent intervals (preferably every sixty days) will, when combined with the immediate removal of reactors and the thorough disinfection of premises, successfully eradicate the disease within reasonable time from a self-contained herd.

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It is not, however, a sound policy to attempt the eradication of the disease by tuberculin testing from grossly infected herds. In these circumstances the building up of a clean herd from young stock should be the aim.

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We have pleasure in acknowledging the assistance received from the Estate Agent and from the Estate Secretary, the prompt and efficient manner in which our recommendations were carried out under their supervision greatly facilitated the work.

RINDERPEST CONFERENCE IN NAIROBI

TEN TERRITORIES REPRESENTED

THE following delegates attended the Rinderpest Conference held at Nairobi earlier in the week:—

Kenya: Mr. R. Daubney, O.B.E., M.R.C.V.S., M.Sc. (Director Veterinary Services); Mr. E. J. Mulligan, M.R.C.V.S. (Deputy Director Veterinary Field Service) and Mr. J. R. Hudson, B.Sc., M.R.C.V.S. (Deputy Director Veterinary Laboratory Services).

Uganda: Mr. W. F. Poulton, C.B.E., M.R.C.V.S. (Director Veterinary Services).

Tanganyika: Mr. H. E. Hornby, O.B.E., F.R.C.V.S. (Director Veterinary Services) and Mr. S. A. Evans, M.R.C.V.S. (Veterinary Research Officer).

Union of South Africa: Dr. P. J. du Toit, B.A. (Director Veterinary Services).

Bechuanaland Protectorate: Mr. J. H. N. Hobday, B.Sc., M.R.C.V.S. (Chief Veterinary Officer).

Southern Rhodesia: Mr. G. C. Hooper-Sharpe, M.R.C.V.S. (Chief Veterinary Surgeon and Mr. D. A. Lawrence, B.V.Sc. (Director Veterinary Research).

Northern Rhodesia: Mr. J. P. A. Morris, M.R.C.V.S. (Director Veterinary Services) and Mr. P. L. Le Roux, B.Sc., M.R.C.V.S. (Veterinary Research Officer).

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Nyasaland: Mr. J. de Meza, M.R.C.V.S. (Chief Veterinary Officer).

Belgian Congo: Dr. Gillain.

Portuguese East Africa: Dr. A. M. Fernandes.

The Kenya Secretariat issued the following communique on Monday's meeting of the Standing Veterinary Research Committee for East Africa:

" A meeting of the Standing Veterinary Research Committee for East Africa was held at Kabete on Monday, the 7th of February, when among other topics the following subjects of common interest to Kenya, Uganda, and Tanganyika were discussed:—

" The control of Rabies.

" Improvements in the preparation and marketing of hides and skins.

" The supply of pleuro-pneumonia vaccine.

" The training of African veterinary personnel.

" Proposals for reinforcing the investigations into various problems of animal health by the creation of a special team of research workers, under inter-territorial control, at Kabete.

" The Committee's recommendations on these various topics are being submitted to the East African Governments for their approval."

Conference Decisions

The following communique was issued through the Secretariat, from the Office of the Conference of East African Governors:—

" A special meeting of the Standing Veterinary Research Committee of East Africa, augmented by the presence of veterinary authorities from the Union of South Africa, the Bechuanaland Protectorate, Northern and Southern Rhodesia, Nyasaland, the Belgian Congo, and Portuguese East Africa, was held in Nairobi on February 8th to review the present position in regard to rinderpest in East Africa and to formulate plans for dealing with such emergencies and eventualities as may arise.

Existing Methods

" After a detailed survey of the present geographical distribution of the disease, the Conference discussed at length the technical methods available for its control, and the lines on which improvement in those methods should be sought. It recorded the following unanimous resolution:—

This Conference, while recognising the need for intensifying research into the technical methods of dealing with rinderpest, is satisfied that the existing methods, although capable of improvement, are adequate not only to

arrest the southward spread of the disease, but also to drive it back towards the north, provided that sufficient staff and funds can be made available for the purpose."

Conveyance by Game

The question next considered was the risk of spreading rinderpest by game, and the following views were recorded:—

> The Conference having reviewed the evidence adduced from the experience of Uganda, Kenya, Tanganyika, and the Belgian Congo, records the opinion that all ungulate game must be regarded as susceptible to rinderpest and capable by their movement of introducing the disease into fresh areas; and that buffalo constitute the most active danger.
>
> The disease can change its virulence from species to species. Fly belts cannot be relied upon as an effective and permanent barrier. Nevertheless rinderpest in game appears to be confined to areas where it is supported by cattle, there is no evidence of the prolonged continuance of the disease in game areas where cattle do not exist.

To Prevent Southward Spread

Attention was then given to drawing up an emergency plan to resist the threatened southward extension of rinderpest from Tanganyika into Nyasaland and Northern Rhodesia, and after the examination of various alternative schemes unanimous agreement was reached in the following terms:—

> The Conferences agrees that the most hopeful method of arresting the southward spread of rinderpest is by the creation of a belt of triply vaccinated cattle, not less than forty miles in depth, and preferably supported by a physical barrier such as the Great Ruaha, the Iringa Escarpment, or an artificially created cattle-free zone, due attention being paid to the risk of the disease passing round the flanks of the belt.

Arrangements were discussed for giving very early practical effect to this scheme, and for ensuring that the cost should not be borne by the Government of Tanganyika alone.

Complete Eradication

The Conference finally devoted its attention to the possibility of eradicating rinderpest completely from those East African territories where it at present exists. Its conclusions were summarized as follows:—

> The Conference, recognising that the plan now formulated cannot be regarded as more than a temporary expedient to arrest the spread of rinderpest, expresses the opinion that the ultimate goal must be the complete

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eradication of the disease from East Africa. It records the view that with the aid of improved technique this goal should be capable of achievement within a reasonable period of time.

It looks with confidence to the Standing Veterinary Research Committee to keep the situation under constant review.

The Conference suggests that it should be summoned to meet again in Nairobi in about a year's time, in order to review the results achieved under the emergency scheme, and, in the light of the data so obtained, to formulate plans for dealing with the broader issue.

From *The East African Standard.*

OBSERVATIONS ON THE BACTERIAL FLORA OF THE INTESTINE OF NORMAL SHEEP

By P. S. WATTS, Ph.D., B.Sc., M.R.C.V.S., Dip.Bact.
Institute of Animal Pathology, University of Cambridge

(*Continued from last issue*)

Isolation of the Anaerobic Bacteria.

A. Preliminary Examination.

Qualitative examinations were made from the casein digest tubes used in the quantitative survey, together with blood agar plates. As already stated, the material was first heated at 72°C. for 30 minutes. In order to remove colonies from the former medium the vaseline seal was melted and poured off and the agar transferred to a sterile Petri dish. The surface of the medium was then seared and the selected colonies taken up with a fine pipette. The plates were soon abandoned as spreading growths of aerobes rendered isolation difficult.

Subcultures were made into meat broth and incubated for 4 days. All the cultures were then sown on blood agar plates from which a representative colony of each type was taken and again cultured in meat broth. The process was repeated at least three times and until the strain appeared pure. A subculture was then made on a blood agar slope and incubated aerobically for four days to ensure that no growth occurred under these conditions. This method of purification was adhered to in all experiments.

Ten sheep thus examined yielded few cultures of anaerobes other than *Cl. welchii.*

Two other media were then included:

(1). Liver broth with the addition of cooked meat and one per cent. salicin (pH. 7.6).

(2). Coagulated egg-white in water (pH. 7.6).

Saccharolytic organisms were encouraged in the first and proteolytic in the second. The cultures were incubated anaerobically for 4 days, plated out on blood agar plates, and purified as described above, repeated plating being necessary since cultures, especially of the non-pathogenic anaerobes, were difficult to free from *Cl. welchii*. Six sheep were examined and 108 cultures (obtained mainly by the use of liquid media) were investigated and classified as:

Cl. welchii	61
Cl. oedematiens	1
Cl. histolyticum	4
Cl. sporogenes	1
Cl. bifermentans	15
Cl. putrificum	2
Cl. sphenoides	2
Cl. multifermentans	7
Cl. tertium	3
Unidentified	12

It will be seen that the most prevalent organisms, *Cl. welchii*, *Cl. multifermentans* and *Cl. bifermentans*, were all of the saccharolytic type.

These results were still not at all satisfactory since most of the organisms were not recovered with any regularity. It seemed evident that anaerobes, other than *Cl. welchii* were present in the intestines in very small numbers only and, as the vegetative forms were destroyed when the material was heated, it was decided to ascertain whether or not a period of storage in the cold room, preliminary to heating, would increase the relative number of spores and thus facilitate the isolation of the organisms. This yielding poor results, the effect of incubating the intestinal contents for 24 hours under anaerobic conditions, was studied. After incubation a portion was taken and examined as before while the remainder was allowed to stand for 7 days at room temperature before being dealt with. In addition to the media already described, "welch-exhausted" broth was used in each instance. This was prepared by growing *Cl. welchii* in meat broth for 7 days after which the reaction was adjusted to pH. 7.8 and the medium sterilised by filtration. Two sheep examined in this manner did not yield any great variety of organisms.

All of these methods had failed to yield many of the varieties of anaerobic bacteria which it was expected were present. Two hundred and fifty-six strains of anaerobes had been obtained from 20 sheep. These were divisible into 9

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types, of which *Cl. welchii* was the only one obtained in every case. The next most prevalent organisms were *Cl. multifermentans* (7 cases), *Cl. putrificum* and *Cl. tertium* (5 cases) and *Cl. bifermentans* (4 cases). Each of the other types was found in a single instance only. (Table VIII).

TABLE VIII.

TYPES OF ANAEROBES ISOLATED FROM A SERIES OF 20 SHEEP.

Organism.	Number of Sheep from which Isolated.	Percentage.
Cl. welchii	20	100
Cl. œdematiens	1	—
Cl. histolyticum	1	—
Cl. bifermentans	4	20
Cl. putrificum	5	25
Cl. sporogenes	1	—
Cl. sphenoides	1	—
Cl. multifermentans ...	7	35
Cl. tertium	5	25

The fact that *Cl. oedematiens*, *Cl. histolyticum*, *Cl. sphenoides* and *Cl. sporogenes* were each recovered from a single sheep only, suggests that they are rare inhabitants of the intestinal tract or occur only in small numbers. In the latter case failure to isolate them more frequently was probably due to the small amounts of inoculum used. This method had served to show, however, that the character of the predominant flora was saccharolytic rather than proteolytic since organisms of the latter type were rarely seen even in egg white medium which favours their growth.

B. Isolation of Non-Pathogenic Anaerobes.

Material from each part of the intestine was placed in boiling tubes and incubated anaerobically at 37°C. Every alternate day until the tenth, two loopfuls were removed from each tube and inoculated into salicin meat liver broth and egg-white media respectively. After being heated at 72°C. for 30 minutes, these were incubated at 37°C. and every third day, until the eighteenth, were plated on to Zeissler's glucose blood agar plates. Aerobes were predominant for the first few days, but when the period had increased to 10 days the proportion of anaerobes of varying types was much greater. Prolonged incubation of the primary cultures in liquid media also appeared to have some beneficial effect, a period of at least 6 days being necessary to ensure the best results. Some indication of the effect of the time factor can be gathered from Table IX which shows the proportion of plates yielding growths of anaerobes, other than *Cl. welchii*, in the case of sheep III. These results are representative of those obtained by this method. In this experiment no attention was paid to *Cl. welchii*, but a colony of each other type was picked from the plates and tested for purity. From four sheep examined in this manner, 116 strains of anaerobes were obtained and their characters fully investigated. The types identified and the parts of the intestine from which they were isolated are shown in Table X, the figures representing the number of sheep from which any organism was recovered.

TABLE IX.

Period of incubation of intestinal contents prior to Culture.	Type of liquid medium.	Period of Incubation of Cultures before Plating.																																	
		3 days.					6 days.					9 days.					12 days.					15 days.					18 days.									
		Duodenum.	Ileum.	Cæcum.	Colon.	Rectum.	Duodenum	Ileum.	Cæcum.	Colon.	Rectum.	Duodenum.	Ileum.	Cæcum.	Colon.	Rectum.	Duodenum.	Ileum.	Cæcum.	Colon.	Rectum.	Duodenum.	Ileum.	Cæcum.	Colon.	Rectum.	Duodenum.	Ileum.	Cæcum.	Colon.	Rectum.					
2 days	L.S.				+				+	+								+	+	+	+			+	+				+			+			
	E.W.									+					+				+	+	+								+			+			
4 days	L.S.		+			+						+	+	+	+		+			+		+	+	+			+	+	+	+	+				
	E.W.		+			+	+				+		+		+								+					+								
6 days	L.S.		+				+	+	+		+		+			+				+		+	+		+										+
	E.W.						+			+	+				+					+	+		+	+	+					+					
8 days	L.S.			+	+			+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+	+			
	E.W.		+	+				+	+		+		+	+					+	+			+	+	+					+	+				
10 days	L.S.		+		+	+		+	+		+	+	+	+	+	+		+	+	+	+			+	+	+	+	+	+	+	+	+			
	E.W.					+	+	+		+	+		+	+		+			+	+			+	+						+	+				

\+ Indicates presence on plates of anaerobes other than Cl. welchii.
L.S. = Salicin meat liver broth.
E.W. = Egg-white medium.

TABLE X.
ISOLATION OF NON-PATHOGENIC ANAEROBIC ORGANISMS FROM 4 SHEEP.

Organisms.	Number of Sheep.				
	Duodenum.	Ileum.	Cæcum.	Colon.	Rectum.
Cl. sporogenes	—	2	4	2	2
Cl. bifermentans... ...	—	3	4	2	4
Cl. multifermentans ...	1	4	4	4	4
Cl. tertium	—	2	3	2	4
Cl. putrificum	2	2	4	3	2
Cl. sphenoides	—	1	2	1	—
Cl. tetanomorphum ...	3	4	4	3	2

The two main facts to be noted are that all the varieties were non-pathogenic and that all except *Cl. sphenoides* were obtained from at least one situation in each of the four sheep.

C. Isolation of the Pathogenic Anaerobes.

Though the above technique demonstrated the presence of the common non-pathogenic anaerobes throughout all parts of the intestine except the duodenum, it failed to yield cultures of any pathogenic organism other than *Cl. welchii*, and was, therefore, abandoned in favour of methods of animal inoculation.

I. Cl. welchii.

Isolation of this organism presented no difficulties it being the commonest anaerobe recovered. Distinct types of the organism are now known and since they have been shown to be associated with certain diseases of sheep such as Lamb Dysentry, Infectious Entero-toxæmia and the condition known as " Struck " in the Romney Marsh area, their distribution in healthy sheep has become a matter of importance. The few strains from normal animals which have been examined by other workers have proved to be either Type A or non-toxic. [Wilsdon (1931), Marsh, Tunnicliff and Jungherr (1932), Montgomerie (1934), Borthwick and Gray (1937).] Bennetts (1932) however, was able to recover Type D from healthy sheep in an area where Entero-toxæmia occurred.*

Forty-six strains which had proved lethal to mice in periods varying from one to 48 hours after the intraperitoneal injection of 0.5 c.c. of a 24-hour Bouillon " V.F." culture were examined as to their type of toxin. The procedure adopted in each case was as follows:

(1). Rapid subcultivation was carried out through 6 successive generations in meat broth.

(2). One cubic centimetre of the 6th subculture was inoculated into 100 c.c. of Bouillon " V.F." to which 0.25 per cent. of glucose, and an excess of calcium carbonate had been added. The medium was taken direct from the steam steriliser and cooled to 37°C. immediately before use.

* Borthwick (B.J.ofExp.Path.18.475) has recovered type D organisms from the intestine of dogs and guinea-pigs.

(3). The culture was incubated at 37°C. and tested for toxicity after periods of 24 hours and 3 days respectively. The former time was chosen as being the most suitable for the demonstration of either A, B or C types of toxin and the latter for type D. On each occasion 20 c.c. was removed, centrifuged at 3000 r.p.m. for 20 minutes and the supernatant fluid decanted. It was not filtered because experience had shown that this was not only unnecessary but was liable to reduce toxicity. Toxin was obtained from 36 of the strains, the minimum lethal dose varying from 0.01 c.c. to 0.25 c.c. In cases where a given strain could not be induced to yield a product which proved fatal in a dose of 0.25 c.c. it was classified, for purposes of this investigation, as non-toxigenic.

In order to determine the type of toxin, as many fatal doses as were contained in 0.5 c.c. were mixed with a known excess of Type A antitoxin, and after standing at room temperature for 1 hour, were injected intravenously into a mouse. This was done in triplicate and at the same time control mice were inoculated with (*a*) 0.5 c.c. toxin mixed with normal serum, (*b*) 0.25 c.c. toxin without serum, and (*c*) 0.5 c.c. of uninoculated medium which had been incubated for the same period as the cultures.

The results showed that the toxin of each of the 36 strains was completely neutralised by Type A antitoxin but not by normal serum. As this antitoxin does not inhibit the action of the toxin of any other type of *Cl. welchii* (Wilsdon 1931) it was concluded that the " B," " C," or " D " types of *Cl. welchii* were not represented in the series. Since entro-toxæmia is not uncommon in this district it had been thought that Type " D " would have occurred.

II. Cl. septique and Cl. œdematiens.

Material from the ileum and cæcum, diluted in saline and injected in doses of 2 c.c. into the thigh muscles of guinea-pigs which had been protected against *Cl. welchii* by the intra-peritoneal injection of antitoxic serum, failed to cause infection. The following method was then adopted:

Tubes of meat broth having been inoculated with 1 c.c. of ileal, or a large platinum spadeful of cæcal, contents, were heated at 72°C. for 30 minutes and incubated for 24 hours. The cultures were again heated at 72°C. for 30 minutes when one cubic centimetre of each was sub-inoculated into a fresh tube of meat broth. After incubation for 30 hours 1 cubic centimetre of the resulting culture was injected intra-muscularly into the thigh of a guinea-pig which had been passively immunised against *Cl. welchii*. In cases where this proved fatal, cultures were made with as little delay as possible from the heart blood and from the lesion at the site of inoculation in the thigh, while films from the latter

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situation and from the liver surface were examined. The cultures were purified by plating on blood agar, and where this failed, by passage through a series of guinea-pigs. In this way an organism having the morphological and cultural characteristics of *Cl. septique* was isolated from four out of a series of 21 sheep. The strains were capable of killing guinea-pigs with typical lesions, while their pathogenic power was completely inhibited by the use of the specific antiserum, and hence their identity was fully established. On one occasion another pathogenic anaerobe, *Cl. oedematiens*, was isolated and identified in a similar manner.

III. Cl. Tetani.

The procedure employed for the isolation of *Cl. tetani* was based on that described by Kerrin (1929), but, as it was feared that direct cultural methods might not always be successful, animal inoculation was also included in the hope of reducing the margin of error. Every culture containing rod-shaped organisms with spherical terminal spores was therefore injected into a mouse which had been passively immunised against *Cl. welchii*. In this way, though, as pointed out by Tulloch (1919), Ninni (1920) and Tenbroeck and Bauer (1922), the formation of tetanus toxin may be inhibited to some extent in mixed cultures, it was hoped that at least local tetanus would be found.

Tubes of meat broth and welch-exhausted medium were inoculated with large amounts of neat intestinal contents. They were then heated to 72°C. for 30 minutes, cooled rapidly and incubated anaerobically for 7 days at 37°C. A large inoculum of each culture was then transferred to a tube of exhausted medium (Tullock 1919) and a peptic digest blood agar slope (Fildes 1925). Films were also made and examined for tetanus-like bacilli and if these were seen 0.125 c.c. of the culture was injected into the base of the tail of a mouse. The cultures in Tulloch's medium were incubated anaerobically for 7 days and then treated in a similar manner, i.e., they were subcultivated on Fildes medium, examined in film preparations, and, where indicated, inoculated into mice.

All tubes of Fildes agar were examined after 24 and 48 hours incubation for evidence of the spreading veil-like growth characteristic of *Cl. tetani*. Where this was seen a tube of meat broth was inoculated from its upper edge, but if no such growth could be detected after 48 hours incubation, an attempt to obtain a culture from the upper part of the slope was still made in order that no growth, however delicate, should be overlooked. These meat broth tubes were incubated for 7 days at 37°C. when the cultures obtained were tested for toxicity by mouse inoculation. The various stages of this technique will perhaps be followed more easily by reference to Table XI.

In the course of this experiment 276 cultures were inoculated into mice and of these 26 proved either to be lethal or to give local tetanus. Each of these was then tested for the presence of tetanus toxin by injection into two groups of mice, (*a*) passively immunised against *Cl. welchii*, and (*b*) similarly protected

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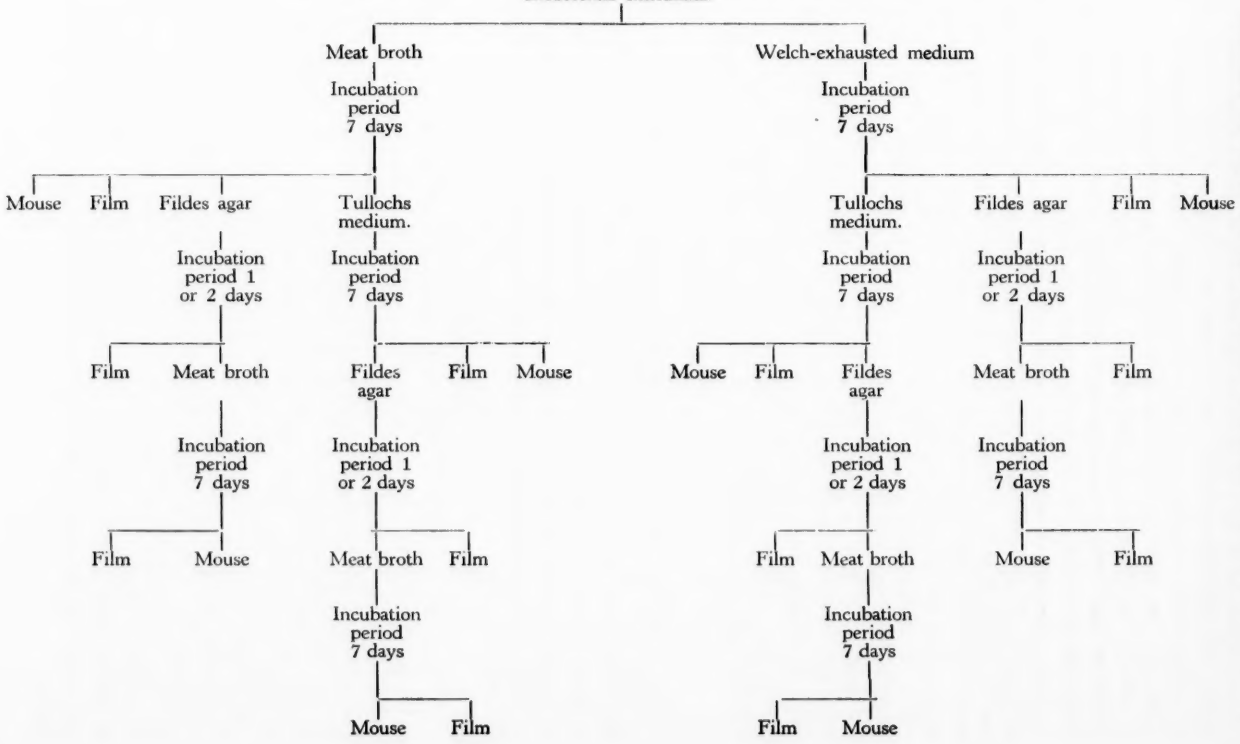
TABLE XI.

DIAGRAMATIC REPRESENTATION OF TECHNIQUE FOR ISOLATION OF CL. TETANI.
INTESTINAL MATERIAL.



against this organism and *Cl. tetani*. Two mice in each group were inoculated in the base of the tail with amounts of 0.25 c.c. and 0.125 c.c. respectively. Three of the cultures so tested caused death with symptoms of tetanus in the first group of mice but had no effect on the second. They were therefore considered to be *Cl. tetani* and were purified by repeated subcultivation on Fildes agar, after which the specificity of their toxin was again checked.

The remaining 23 cultures, in which the presence of tetanus toxin had not been detected, were repeatedly subcultivated in Tulloch's medium and transferred to Fildes agar slopes. Two further strains of *Cl. tetani* were recovered by this means and their identity confirmed by animal inoculation. In one case a strain was isolated showing typical morphology and growth on Fildes agar but from which no toxin could be obtained after repeated attempts. Its biochemical reactions were those of *Cl. tetani*, and although its agglutinating properties were not studied it was provisionally classified as non-toxigenic variety of that organism. Five toxigenic strains were obtained from separate individuals in a series of 32 sheep, 1 being recovered from the cæcum, 2 from the colon and 2 from the rectum. The percentage of positive cases was, therefore, 15.6 as compared with 17.4 per cent. reported by Kerrin (1929) and 25 per cent. by Piening (1932).

DISCUSSION.

In considering the results of this investigation it has not been possible to compare them as a whole with the findings of other workers since very few observations on the bacterial flora of the sheep's intestine appear to have been made and these have been rather limited in their scope. The results may be reviewed, however, in the light of the data available for animal species in general, of which the most complete and precise are those which have been established in the case of man.

Small Intestine.

The viable aerobes were found to be less than 1×10^6 per cubic centimetre in the duodenum but rose until they might approach 10 times that number in the ileum. Few or no anaerobes were present in the former situation, and never exceeded 1×10^4 per cubic centimetre in the latter. These findings are consistent with those obtained by Smith and Orcutt (1925) and Tunnicliff (1932) for young calves and lambs respectively, although actual figures are not given in either of these articles. In the small intestine of man, MacNeal and Chace (1913) found less than 100 aerobic organisms per cubic centimetre and Goldman (1924) reported that aerobes varied from 140 to 290,000 but that no anaerobes were present. Other authors who agree that a small obligate flora is present are Gessner (1889), Hess (1912), Mutch (1921), Ganter and Van der Reis (1921), Bogendorfer (1922), Aronovitch, Coleman and Einhorn (1922), Van der Reis (1922), Kendall et alia (1927) and Sanborn (1928). On the other hand, Escherich (1886) and Hoefert (1921) maintained that, in health, the duodenum of man is sterile.

The reason for bacteria being so scanty in the upper part of the small intestine has been much debated. It seems to be established that the acidity of the stomach destroys a large proportion of organisms ingested with the food while the duodenum is sufficiently acid to inhibit the growth of *Bact. coli.* and other fæcal types (Arnold 1929). Whether this, in itself, is responsible for the scarcity or whether other factors such as peristalis, decomposition products, and inhibiting substances derived either from the bacteria themselves or from the intestinal mucosa, may play a part, has been discussed by Rolly and Liebermeister (1905), Goldman (1924), Arnold (1929), Dack (1934) and Teale (1934). The consensus of opinion appears to be that the maintenance of bacterial equilibrium is subject to all these influences.

The predominating type found in the small intestine of sheep was *Bact. coli*, this being the only organism regularly obtained from highly diluted material. Aciduric bacilli, *Strep. faecalis* and certain members of the Clostridium group could usually be demonstrated by special methods, and a variety of other types were less frequently encountered. Taking these results in conjunction with those of other workers, it would appear that *Bact. coli* is the predominant organism in the upper part of the intestine in herbivora, whereas cocci are more numerous in this situation in both man and the dog.

Large Intestine.

Owing to the difficulty of counting colonies, occasioned by the presence of members of the bacillus group, no figures could be obtained for the number of aerobes present in the colon and rectum. In the cæcum, however, they varied from 10×10^6 to 45×10^6 per cubic centimetre of contents. The chief type was again *Bact. coli* and the flora, though more abundant, was very similar in character to that of the ileum except that members of the Bacillus group and cellulose-splitting bacteria were more commonly found.

It proved possible to obtain an approximate estimate of the number of anaerobes throughout the large intestine. This varied from 1×10^3 to 1×10^6 and appeared to be very uniform at various levels in individual animals. As far as has been ascertained, however, no comparable figures relating to man or animals are on record. Certain articles describing the quantitative estimation of the flora of human fæces have been consulted, but as the results are given on a different basis they cannot usefully be applied here. [Strasburger (1902), MacNeal, Latzer and Kerr (1909), Chapman (1928), Davidson (1928) and Sanborn (1931)].

All the common non-pathogenic members of the clostridium group were isolated with regularity, especially from the cæcum. They were relatively scanty, however, as compared with *Cl. welchii*, which vastly outnumbered any

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other type, as it did, also, in the small intestine. Of the other pathogenic anaerobes *Cl. tetani* and *Cl. septique* were recovered by the aid of special methods from a limited proportion of animals while *Cl. oedematiens* and *Cl. histolyticum* were observed in one or two cases only.

All the non-pathogenic anaerobes whose isolation is here recorded may be regarded as normal inhabitants of the alimentary tract of man and animals since their presence in fæces has been noted by all workers who have studied the bacterial flora. Of the potentially pathogenic types, however, *Cl. welchii* alone has been found with any regularity and it has proved to be the most common of all anaerobes in both man and animals. [Kahn (1924), Krameveld (1932, 1933)]. In this investigation it was found to be present in every case and in vastly greater numbers than any other member. A representative series of 46 strains was tested and of these 36 were found to produce toxin of Wilsdon's Type A, while the remainder were non-toxigenic. There was, therefore, no evidence of the presence in the intestine of Types B, C or D.

Considerable attention has been paid by workers in general to *Cl. tetani* which has been isolated from the fæces of man and animals on many occasions. The percentage of positive results appears to have varied considerably with the locality, since, for example, Tenbroeck and Bauer (1922) obtained it from 34 per cent. of samples of human fæces while Kahn (1924) and Kerrin (1929) were unsuccessful in finding it. From horses Sanchez, Toledo and Veillon (1891) obtained it from four cases out of 6, Fildes (1925) from 16 per cent., and McLeod, Soga and Roger (quoted by Browning, 1916) from 3 per cent. only. Noble (1915) examined 21 cattle with negative results whereas Fildes (1929) was successful in 44 out of 55 cases. The figures obtained for sheep are 17.4 per cent. by Kerrin (1929), 25 per cent. by Piening (1932) and 15.4 per cent. by the writer. Since the rate of incidence of tetanus cases in man is high in Cambridgeshire and the surrounding districts (Young 1927) it was thought that the percentage of positive cases in the present investigation might have been higher than proved to be the case.

The evidence for regarding *Cl. septique* as a normal inhabitant of the intestine of animals is mainly indirect. Thus it is known to be a common post-mortem invader of the tissues [Ruppert and Rottgardt (1926), Newson, Cross and Dobbins (1929)], and to be relatively abundant in highly manured soils [Seddon and Edgar (1930), Sasaki (1934)]. So far as has been ascertained, however, Piening is the only author actually to record its isolation from the intestine, having obtained it from 15 per cent. of samples of dried sheep's gut. In the present investigation it was recovered from fresh material in 19 per cent. of cases. No percentage figures can be given for *Cl. oedematiens* or *Cl. histolyticum* since only 2 strains of the former and one of the latter were obtained. Piening has shown that both organisms may be found in the intestine of normal sheep while Edgar (1928) and

TABLE XII.

Part of Intestine.	pH.	Aerobes. Number per c.c.	Aerobes. Usually present.	Aerobes. Occasionally found.	Anaerobes. Number per c.c.	Anaerobes. Clostridia usually present.	Anaerobes. Occasionally found.
Duodenum.	6.46	Less than 1×10^6	Bact. coli. Strep. fæcalis. Staph. albus. Aciduric bacilli.	Mic. luteus. B. subtilis. B. mesentericus. Corynebacterium. Cellulose bact.	Few or none.		Welchii. Putrificum. Multifermentans. Tetanomorphum.
Ileum.	7.65	1×10^6 to 10×10^6	Bact. coli. Strep. fæcalis. Aciduric bacilli.	Staph. albus. Mic. luteus. B. subtilis. B. mesentericus. Corynebacterium. Cellulose bact.	0 to 1×10^4	Welchii. Multifermentans. Tetanomorphum. Bifermentans.	Tertium. Sporogenes. Putrificum. Sphenoides. Septique.
Cæcum.	7.52	10×10^6 to 45×10^6	Bact. coli. Strep. fæcalis. Aciduric bacilli. Cellulose bact.	B. subtilis. B. mesentericus. B. megatherium. B. mycoides. Staphylococci. Mic. luteus. Proteus vulgaris.	1×10^3 to 1×10^6	Welchii. Sporogenes. Bifermentans. Multifermentans. Tetanomorphum. Tertium. Putrificum.	Sphenoides. Tetani. Histolyticum. Oedematiens. Septique.
Colon.	7.77	Not examined.	Aciduric bacilli. Cellulose bact. (Not examined for other organisms).		1×10^3 to 1×10^6	Welchii. Multifermentans. Putrificum. Tetanomorphum. Sporogenes.	Oedematiens. Histolyticum. Tetani. Bifermentans. Tertium. Sphenoides.
Rectum.	8.00	Not examined.	Aciduric bacilli. Cellulose bact. (Not examined for other organisms.)		2×10^3 to 1×10^5	Welchii. Bifermentans. Multifermentans. Tertium.	Tetani. Histolyticum. Sporogenes. Putrificum. Tetanomorphum.

Turner (1930) have reported the presence of *Cl. oedematiens* in the liver of apparently healthy animals in "Black Disease" areas in Australia. *Cl. histolyticum* has been found occasionally in the fæces of human beings in health and disease [Hall (1923), Torrey (1925)], while both it and *Cl. oedematiens* have been found on many occasions in cultivated soil.

Although it has not been possible to demonstrate the presence of the majority of pathogenic anaerobes in more than a limited number of cases it is felt that they are more often present than these results would suggest and that the difficulty experienced in detecting them is due primarily to the fact that they occur in very small numbers in normal animals.

Summary.

1. The bacterial flora of the intestine of normal sheep has been studied in order to determine the number and types of organisms of which it is composed. The results are set out in the form of a chart in Table XII.

2. The number of viable aerobes was less than 1×10^6 in the duodenum and did not exceed 10×10^6 per cubic centimetre in the ileum.

3. The predominant aerobe in the small intestine was *Bact. coli*. Others usually present were *Streptococcus fæcalis* and Lactobacillus while cellulose-splitting organisms and members of the Bacillus group were recovered in some cases.

4. The anaerobes varied in number from few or none in the duodenum to a maximum of 1×10^4 per cubic centimetre in the ileum.

5. The predominant anaerobe was *Cl. welchii*. Certain other varieties were present in small numbers in a proportion of cases only.

6. The number of viable aerobes in the cæcum varied from 10×10^6 to 45×10^6 per cubic centimetre.

7. *Bact. coli* was again the predominant aerobe but members of the Bacillus group were relatively more numerous than in the small intestine. Lactobacilli, *Strep. fæcalis* and cellulose-splitting organisms were constantly present.

8. Viable anaerobes numbered from 1×10^3 to 1×10^6 per cubic centimetre throughout the large intestine.

9. *Cl. welchii* was found in very much greater numbers than any other anaerobe but the various non-pathogenic species were always present.

10. Of toxigenic varieties of the former none but Type A was demonstrated.

11. *Cl. tetani* and *Cl. septique* were found to occur in a proportion of cases.

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The former was recovered from 15 per cent. and the latter from 19 per cent. of animals which were specially examined for their presence.

12. *Cl. oedematiens* and *Cl. histolyticum* proved to be very rare, the former being isolated from 2 animals and the latter from 1 only.

13. The hydrogenion concentration of the contents of each part of the intestine was determined and it was found that the reaction did not vary greatly in any case from the mean values obtained for the series of animals examined.

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XUM

Clinical Articles

ENTEROTOMY IN AN ABERDEEN TERRIER

By RICHARD HUDSON, F.R.C.V.S.
Retford

THE subject was a three-year-old bitch in fair condition. For about eight or nine weeks there had been slight vomiting usually in the morning. The vomit being white mucous. Food had been retained and she was fat and lively.

About a fortnight before the operation she was brought to me because she vomited more frequently. I could not find much the matter, thought she was a gastric catarrh case and prescribed Chlorbutol. Vomiting was checked for a few days, then it began again. The vomit later became foul smelling and reddish in colour, probably due to raw meat which was taken and retained about four hours before being brought back.

The patient was now seriously ill, temperature being 103F. and pulse fast and weak. For some days there had been no passage of fæces. The abdomen was fairly flacid and although carefully examined nothing could be felt, still, one could easily miss a foreign body and suspecting that there might be one I sent her to our hospital for X-ray examination.

The negative showed a faint shadow on the left side of the abdomen, but nothing could be felt on further palpation. However, we had reached a crisis and it was decided to operate. Preparing the patient in the usual way, 1¼ grains morphia had put her well asleep and 1 c.c. 2½% Sol. Cocain rendered the incision painless. A central abdominal incision, about 2 inches long was made in the middle line and introducing my finger towards the left side I soon found the part of intestine containing the foreign body. It was gently drawn through the opening and laid on the sterile cloth. A length of small intestine about five inches, was swollen, inflamed and appeared about the texture of liver. In the centre was the foreign body. No attempt was made to move it to a safe place, the area was so fragile and I doubt if I could have pushed it into normal intestine, owing to its size.

Excision of the inflamed portion was considered, but the joining up by suture looked too difficult with such a narrow gut.

Knowing the wonderful recuperative power of inflamed bowel I decided to open the bowel and suture the opening. The incision was made along the

outer curvature until the foreign body escaped under gentle pressure. The edges were cleaned and brought together with a continuous suture of very fine silk worm gut passed through all the layers of the wall. Lembert sutures as deep as possible were then inserted. All but the last two held and I had some difficulty with them before I could find a secure hold.

The wound and bowel were sponged over with carbolic lotion and dressed with Iodoform 1 dram, Ether 1 ounce, Oil 7 ounces, to lubricate and help its easy passage into the abdomen.

The muscles and peritoneum were included in the deep, and the skin and muscles in the superficial sutures, the wound was coated with Iodoform and Boracic Acid and a similar dressing on cotton wool secured by bandage.

Recovery was really wonderful. About the second day the patient was ravenous for food, though only a little water and milk and water were allowed for a week.

After a week the wound was examined and found to be leaking at one end. Two or three sutures were removed, the cavity sponged out with weak formalin lotion and rebandaged. The suture abscess delayed healing but never looked serious, and in about a fortnight the wound was safe.

The foreign body proved to be a piece of soft solid rubber ball and it must have been in the stomach three months, because the owner changed residences about that time and the ball had then been thrown away.

No doubt its presence in the stomach accounted for the early vomiting symptoms and as long as it remained in the stomach no serious symptoms occurred, but later, when it passed into the intestine the symptoms quickly became alarming.

I have been told that rubber will not " show up " under X-rays but in this case it showed distinctly.

I have found that bowel has a wonderful recuperative power and this case proves it for the bitch is now (two months after) as fit as ever she was.

In another case, one of intussusception with bowel protruding at the anus, when the invaginated portion was withdrawn, about two inches of bowel was so denuded of its outer layers as to be almost transparent. Its position at the entrance to the pelvis made sections and joining up the divided ends practically impossible, so it was left as it was with the result that the animal made a good recovery.

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AN UNUSUAL WHELPING CASE

By MARY L. SOMERVAIL, M.R.C.V.S.

Worthing.

Subject: Dachshund bitch aged 5 years.

History: The bitch had produced three litters quite uneventfully. She was mated in the Sping of 1936, but failed to have any puppies, and was not mated again until the following year, being due to whelp on April 7th. On March 16th, when out exercising she gave a scream and passed a brownish object which proved to be a mummified foetus in an early stage of development. On April 1st three more mummified pups were passed, but these were more mature than the first. On April 12th one live, normal and healthy dog pup was born.

Remarks: One wonders whether the mummified pups were the result of the unsuccessful mating of 1936, or whether they were the litter brothers and sisters of the live puppy.

CURIOUS CASE OF LAMENESS IN A CAT

By MARY L. SOMERVAIL, M.R.C.V.S.

Worthing

Subject: Neuter male cat aged 3½ years.

History: The cat was first brought to the surgery in September, as it had been limping since the previous day when the owner had trodden on its right fore paw. No injury was apparent and no pain on manipulation of the leg, so it was presumed that there was very little the matter. A fortnight later the owner called in to say that the cat still went lame and held up his paw occasionally, but went perfectly sound if anything occurred to distract his attention from himself.

On October 26th, the animal was brought again, as the lameness seemed to alternate between the two fore legs and quite frequently it would sit up in a begging position for hours on end. It could, however, curl up in the normal position for sleeping, and the appetite was good without rise in temperature. At this stage, Mr. Kelly, F.R.C.V.S., of Worthing, also saw the animal in consultation and the conclusion was drawn that rheumatism was the cause, so pot. iod. in gr¼ doses daily was prescribed. On November 2nd, the cat was again seen and appeared to be better, since it only limped occasionally, although it still continued to sit up on its haunches with its forelegs off the ground; there was some evidence of pain in the shoulder regions. Early in December the patient was reported to be eating enormously and to be in good health apart from the fact that he was now attempting to walk upon his hindlegs only; the question of an X-ray examination was raised, but was rejected by the owner. On January 14th,

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Bull Calf, Eight Days Old.
The Result of an Artificial Insemination.

the owner rang up to say that the cat had eaten a large meal, been violently sick and had died a few minutes after.

Post-mortem findings: The abdominal organs appeared to be more or less normal, but on opening into the chest cavity about half a pint of very evil smelling, dirty greyish pus poured out, and every organ was in a state that can only be referred to as decomposition, whilst the pleuræ were covered with small white hard nodules. Post-mortem examination was made about 2 hours after the animal died.

Remarks: Throughout the entire case there would seem to have been no symptoms to indicate that the chest was the seat of the trouble, and it seems surprising that the appetite remained unimpaired and that there was no variation in temperature at any time.

Abstracts

ARTIFICIAL INSEMINATION IN THE COW

By DR. ARMIN SCHWAB

Practising Veterinarian in Büren a/Aare Schweizer Archiv f. Tierhlk, January, 1938.

After studying the literature on the problem of artificial insemination in the domestic animals and subsequent to my State examination, I had the opportunity of seeing artificial insemination performed in Giessen, Hannover and Bern, and later on used it in my practice.

Herewith I give an account of the first eleven cases in which normal pregnancy followed artificial insemination. The calves were all born alive and developed normally.

The first bull calf, born on May 17th, 1936, was photographed 8 days after birth and 6 weeks later weighed 113Kg. The length of pregnancy in the mother animal was 9 months and 20 days, which is about normal. No interference with the breeding propensity of the dam was noticed to follow artificial insemination. The use of the same semen twice had no influence on the duration of pregnancy. What percentage of cows proved pregnant following artificial insemination is not stated but conception is certainly better than in most herds after natural service. Artificial insemination in cattle is easily carried out in practice. With one supply of semen, several cows (5–10) may be inseminated. It is of great importance in the fight against sterility and must be further explored.

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Date of Art. Insem.	Length of Time Sperm Kept	Distance of Bull from Cow	Method of obtaining Sperm	Date of Birth	Sex of Calf	Remarks
27/ 7/35	1 hour	2 kilometres	Massage of seminal vesicles	17/ 5/36	Bull calf	
3/12/35	2 hours	8 kilometres	Phantom	15/ 9/36	Bull calf	
7/12/35	4 hours } same sperm	25 kilometres	Phantom	24/ 9/36	Bull calf	
7/12/35	4 hours } same sperm	25 kilometres	Phantom	24/ 9/36	Heifer calf	
11/12/35	¾ hour } same sperm	2 kilometres	Phantom	26/ 9/36	Heifer calf	
11/12/35	¾ hour } same sperm	2 kilometres	Phantom	24/ 9/36	Bull calf	
2/ 1/36	¾ hour	2 kilometres	Phantom	20/10/36	Heifer calf	
21/ 1/36	¾ hour	2 kilometres	Phantom	7/11/36	Bull calf	
25/ 1/36	1 hour } same sperm	2 kilometres	Phantom	11/11/36	Heifer calf	
25/ 1/36	1 hour } same sperm	2 kilometres	Phantom	16/11/36	Bull calf	retained placenta
5/ 3/36	1 hour	2 kilometres	Phantom	16/12/36	Bull calf	

VASELINE INJECTIONS IN FISTULA OF THE PAROTID GLAND OF THE HORSE

By DR. G. TOCO

Il Nuovo Ercolani, 1937. No. 9.

FOR the treatment of fistula of the parotid gland in the horse the author injects 100 c.cm. of pure white Vaseline into the gland. With the object of distributing the liquid evenly into the substance of the gland the injection must be made slowly and gradually. If the injection is done in this way complications are rare. The operation is best done with the head stretched out and is concluded with the ligaturing of the aboral portion of the parotid duct in order to prevent any back flow from the fistula. Recovery occurs in a few weeks as a result of disfunction of the gland. In comparison with all other methods of treatment this procedure causes healing in the shortest time.

Reviews

Gaiger and Davies Veterinary Pathology and Bacteriology 2nd Edition, revised by GWILYM O. DAVIES. Pp. xii+712. 195 figs. Price 25s.

WHEN the first edition of this book was published in 1932, it was readily welcomed by all English speaking veterinarians, but unfortunately during the intervening period Professor Gaiger died, so that Mr. Davies is left as sole author of this important work. His task has been an arduous one, but nevertheless well accomplished, and as a standard textbook to be used by student and practitioner alike, it is to be well recommended.

Unfortunately, the text has increased by about 100 pages and a number of additional illustrations, but it is to be hoped that Mr. Davies will not be tempted to keep increasing its volume as added facts become known. If anything, it has already reached its maximum size for comfort, so that one would suggest that future editions be culled for all matter not of real value to the practising (or would-be practising) veterinary surgeon. Perhaps, also the author will insert only those photographs which depict quite clearly the details they are intended to portray.

The book is divided into four sections dealing respectively with Part I—General Pathology, Part II—Specific Diseases—Bacteriology and Pathology, Part III—Special Pathology, and finally, an Appendix of Laboratory Technique.

To the reviewer Part II and the Appendix make a special appeal, because they are essentially veterinary and the information given is such as cannot be obtained easily from other books.

It is written in an attractive style—easy to read—and the facts are stated clearly and without embellishment. In this second edition, there have been some changes made regarding the nomenclature of bacterial species. In addition, Chapter XXVIII has been altered to conform to the known aetiology of the diseases concerned—notably Contagious Bovine Pleuro-pneumonia.

Concerning Foot and Mouth Disease, Mr. Davies considers the incubation period to be from 2—4 days, whereas 5—17 days is apparently the time agreed upon by Ministry Officials in the field; similarly, one of the major symptoms in the present outbreaks has been *stiffness* of the limbs, rather than lameness.

In view of the publicity given to poultry and their diseases at this time, it is natural that this textbook should be consulted on these matters, and the following criticisms are offered:

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In Fowl Pox, the lesion does not appear clinically first as a vesicle, but always as a solid proliferating nodule. The diagnosis (post-mortem) of the Leukæmias is based more on the distribution of the lesions (liver, spleen, kidney and bone marrow) than on examinations of the blood. In view of the important work of the Imperial Cancer Research Fund on Fowl Tumour viruses, is not this a portion of the book which could well be elaborated at the expense of some of the less important subjects, e.g. Balantidium coli? Then regarding B.W.D. in chicks, surely deaths are not heaviest during the first six days, and often so rapid that naked-eye lesions are absent? Tuberculosis in poultry is stated to be seen not often in fowls less than one year old, yet statistics show that nearly half of all cases occurring nowadays are in pullets. Finally, why is the paragraph on Fowl Paralysis so diminutive, unless perhaps to emphasise our lack of knowledge rather than our appreciation of this scourge.

Concerning Abortion in cattle, the procedure outlined by Mr. Davies (page 225) for the collection of blood would appear to be rather ponderous under working conditions, and is the quantity of blood required to be 15—30 c.c., or 3 c.c. (page 644)? In many cases in cattle the mammary vein is more accessible than the jugular, it does not require any tourniquet, nor does the skin require to be cut with a scalpel. Also, may one be quite safe in not vaccinating bulls " because they do not often become naturally infected " (abortus infections); and is it not a fact that *Br. abortus* organisms can only be cultivated from the blood of Undulant Fever patients during life in but a very small percentage of cases (circ 15%.)?

The text dealing with Rickets would be much improved with a diagram or X-ray photograph of an offending bone and by adequate references to the effects of Cod Liver Oil and sunshine where prevention of this disease is concerned.

After the above review, readers may perhaps feel that " Veterinary Pathology and Bacteriology " is a book to be read with undue critical comment, rather than to accept it at its face value. Such is not the case. Gaiger and Davies laid the foundation in 1932 for a literary triumph, and their work was gladly accepted by our profession. Mr. Davies has consolidated that task, but it is not yet completed, and it is to be hoped that the above review is constructive—not destructive—and the writer desires to offer sincere congratulations to the author on the work achieved. It is a magnificent textbook and no veterinary surgeon can be without it.

The publishers, Messrs. Baillière, Tindall & Cox, have again performed their work accurately and well.

News

FOOT-AND-MOUTH DISEASE RESEARCH

THE Minister of Agriculture and Fisheries has recently had under consideration the question of the future of research work into foot-and-mouth disease which is being conducted under the control of the Foot-and-Mouth Disease Research Committee.

The problem under investigation is a complex one, and its scope has become wider than was envisaged when the work was first started fourteen years ago. There is increasing evidence of the necessity for pursuing the intensive study of this particular member of a group of diseases affecting human beings, animals and plants in close relationship with investigations into virus diseases generally and of enlisting the experience of workers in other fields of virus research in the elucidation of the problems connected with foot-and-mouth disease.

In the circumstances, the Minister, after consultation with the Development Commissioners, has come to the conclusion that it would be an advantage if the Agricultural Research Council and the Medical Research Council were more actively and directly associated with the work of the Committee than at present, and, with this object in view, has decided to broaden the basis of the Committee by appointing additional members, in consultation with the two Councils. He has accordingly appointed the following to serve on the Committee:—

Professor S. B. Bedson, M.D., M.Sc., F.R.S. (of the London Hospital).
Professor T. Dalling, M.A., M.R.C.V.S. (Director of the Institute of Animal Pathology, Cambridge).
Major G. W. Dunkin, M.R.C.V.S., D.V.H. (Director Agricultural Research Council Field Station).

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G. M. Findlay, Esq., C.B.E., M.B. (of the Wellcome Bureau of Scientific Research).
Professor H. B. Maitland, M.B., M.Sc. (of the University of Manchester).
Professor F. C. Minett, M.B.E., D.Sc., M.R.C.V.S. (Director, Research Institute in Animal Pathology, Royal Veterinary College).
J. Henderson Smith, Esq., M.B., Ch.B., B.A. (of the Rothamsted Experimental Station).
The existing members of the Committee are as follows:—
Sir Joseph Arkwright, M.D., B.Ch., F.R.C.P., M.R.C.S., F.R.S.(Lister Institute of Preventive Medicine), *Chairman*.
Dr. W. Horner Andrews, M.R.C.V.S. (Director of Veterinary Laboratory, Ministry of Agriculture and Fisheries).
Professor W. Bulloch, M.D., F.R.S. (Professor of Bacteriology, University of London).
hrofessor J. Basil Buxton, M.A., F.R.C.V.S., D.V.H. (Principal of the Royal Veterinary College).
Dr. J. Russell Greig, M.R.C.V.S. (Director of the Moredun Institute, Gilmerton, Midlothian).
Sir John Kelland, M.R.C.V.S. (Chief Veterinary Officer, Ministry of Agriculture and Fisheries).
Sir Patrick Laidlaw, B.Ch., F.R.C.P., F.R.S. (Director of the Department of Experimental Pathology, National Institute for Medical Research).
Dr. Charles Todd, O.B.E., M.A., F.R.S. (National Institute for Medical Research).
V. E. Wilkins, Esq., O.B.E. (Ministry of Agriculture and Fisheries).

Ministry of Agriculture and Fisheries, 10, Whitehall Place, S.W.1. 22nd February, 1938.

AGRICULTURAL ACT, 1937

Part IV.—(Provisions as to Diseases of Animals)

The Appointed Day

THE Minister of Agriculture and Fisheries has made an Order under Section 34 (3) of the Agriculture Act, 1937, directing that, save as otherwise expressly provided therein, Part IV of the Act shall come into operation on the 1st April, 1938. As and from that date the functions of veterinary inspectors in Great Britain under the Diseases of Animals Acts and any enactments relating to milk or to dairies will accordingly be discharged by veterinary inspectors appointed by the Minister of Agriculture and Fisheries.

In order to facilitate the smooth transfer of functions on the Appointed Day, the Superintending Inspectors and Divisional Inspectors who will be in charge of the 22 Areas and 78 Divisions into which Great Britain has been divided for the purposes of the field organisation of the augmented State veterinary service, have already taken up duty in their respective Areas and Divisions. The officers appointed to posts as Superintending Inspector and Divisional Inspector include a number of veterinary inspectors of local authorities. The remainder of the whole-time veterinary staff of local authorities, if they have applied for and been offered appointments under the Ministry, will be transfered to the State veterinary service on the 1st April, 1938.

Ministry of Agriculture and Fisheries,
10, Whitehall Place,
London, S.W.1.

SYDNEY UNIVERSITY VETERINARY SCHOOL ESTABLISHES FARM

ACCORDING to a report in the *Australian Veterinary Journal*, the Sydney University Veterinary School has established a farm of 400 acres for the training of its students in animal husbandry. A dormitory for accommodating from 25 to 30 students has been provided. Each group will spend a month on the farm during vacations and will also spend week-ends and holidays to see certain operations such as shearing and lamb marketing. All farm animals are used in the management of the farm. The experience gained on the farm will supplement the formal lectures in animal husbandry.

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Notices

FOURTH INTERNATIONAL CONGRESS OF COMPARATIVE PATHOLOGY.

THE IVth International Congress of Comparative Pathology will meet in Rome, from the 15th to the 20th of May, 1939, XVII, under the auspices of the Government.

Organisation Committee:—President: H. E. Professor Pietro Rondoni. Members: Professor Carmelo Ciaccio; Dr. Ugo Frascherelli; Professor Guido Guerrini; Professor Alessandro Lanfranchi; Professor Domenico Marotta; Senor Professor Nicola Pende; H. E. Professor Giovanni Petragnani; Professor Lionello Petri; Senor Professor Nazzareno Strampelli; Professor Guido Vernoni. Secretary: Professor Vittorio Zavagli.

The Congress comprises three sections:—Section of Human Medicine; Section of Veterinary Medicine; Section of Phytopathology.

The themes will be:—Ultravirus Diseases; Heredity in Pathology; Function of the Associated Antigenes; Regressive Processes in Plants.

The official languages are: Italian, French, English, German, Spanish.

For further informations apply to the Hon. Secretary, British National Committee, 10, Red Lion Square, London, W.C.1, or to the General Secretary, *Consiglio Nazionale delle Ricerche*, Piazzale delle Scienze, Rome.

Publishers' Notices

All communications should be addressed to 7 and 8, Henrietta Street, Covent Garden, London, W.C.2. Telephone: Temple Bar 8568. Telegrams: "Baillière Phone, London."

Letters for the JOURNAL, literary contributions, reports, notices, books for review, exchanges, new instruments or materials, and all matter for publication (except advertisements) should be addressed to the Editor.

Copy of advertisements should be in the hands of the publishers—Baillière, Tindall and Cox—not later than the 25th of the month, or if proof is required, not later than the 23rd.

Binding Cases for Volume 92 and any other previous volumes can be obtained from the publishers. Price 2*s*. 9*d*. post free.

Annual Subscription, 21*s*. ($5.00 U.S.A. currency), post free.

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